



West, Newman photo-lith.

VI.—*Some Tardigrada of the Sikkim Himalaya.*

By JAMES MURRAY.

(Read February 20, 1907.)

PLATE XIV.

THE Tardigrada enumerated in this list were obtained from moss sent by Mr. A. Gage, Superintendent of the Royal Botanic Gardens, Sibpur, to Mr. N. D. F. Pearce, Cambridge. There have already appeared in this Journal lists of species of several groups obtained in this moss—Oribatidæ (p. 269, June, 1906); Rotifera (p. 637, Dec., 1906)—and Dr. Penard's account of the Rhizopods appears in this same number.

There are 14 species in the list, comprising 4 species of *Echiniscus*, 8 of *Macrobiotus*, 1 *Diphyscon*, and 1 *Milnesium*. Two of the species of *Macrobiotus* were previously undescribed.

There are besides many forms, some of them doubtless distinct from any known species, which could not be sufficiently studied.

Five of the identifications are not absolutely certain.

Genus *Echiniscus*.

E. arctomys Ehr. (♂).—In one sample only, from Gokdhara, 3000 ft.; several examples living.

E. mutabilis Murray (♂).—In two samples, both from Sinihul, 8000 ft. They belonged to the type of the species, with large dots on the plates, and the barbs of the inner claws were seen. Many living, and some skins with two or three eggs.

E. reticulatus Murray (♂).—Sinihul, 8000 ft., several living, and one skin with four eggs.

E. quadrispinosus Richters (?) (♂).—Darjiling, 6000 ft., and

EXPLANATION OF PLATE XIV.

- Fig. 5a.—*Macrobiotus rubens* sp. n. Ventral view.
 ,, 5b. ,, ,, Teeth and pharynx.
 ,, 5c. ,, ,, Claws.
 ,, 5d. ,, ,, Egg.
 ,, 6a.—*M. indicus* sp. n. Dorsal view.
 ,, 6b. ,, ,, Teeth and pharynx.
 ,, 6c. ,, ,, Side view of claws.
 ,, 7.—*M. echinogenitus* Richters var., teeth and pharynx.

Baghghora, 6000 ft. This animal is doubtfully united to Richters' species because the arrangement and texture of the main plates are the same as in examples of *E. quadrispinosus* which Professor Richters was kind enough to give me, and because the larva has, as Richters states (9) only the two lateral processes *a* and *e*. There are several points of difference which render the identification doubtful, but as only young individuals were seen (two-clawed larvæ and four-clawed examples hardly larger than the larvæ), it would be unsafe to build on these differences. The larvæ had no dorsal processes; the subsidiary plates among the larger plates were not detected; the lateral spine *c* had a thick basal portion, with a shoulder, succeeded by a thin apical portion. The two-clawed larva had four claws developed on the new skin inside. Several examples 150 μ long.

Genus *Macrobotus*.

M. hufelandi C. Sch. (12).—Common in moss from Sinihul, 8000 ft., and Baghghora, 6000 ft. There is always an amount of doubt about an identification of a *Macrobotus* if the egg is not seen (compare *M. rubens* below, which closely resembles *M. hufelandi*, but has a quite different egg). Typical eggs of *M. hufelandi* were also abundant, and some well-developed young were squeezed out of eggs.

M. rubens sp. n., plate XIV. fig. 5a to 5d.

Specific Characters.—Of moderate size and reddish-brown colour. Eyes present. Pharynx of *hufelandi* type, with a nut attached to the gullet, a long double rod, a shorter rod, and a comma in each row. Claws of *hufelandi* type, joined about half-way. Egg oval, laid in the skin.

Length, up to 430 μ . Eggs up to five in one skin. There appears to be only one supplementary point to each long claw, but this is difficult of demonstration. It is the first species known to me, of the *hufelandi* type of claws, which does not lay a spiny egg. As both claws and pharynx conform to the *hufelandi* pattern, the distinction from that species would be difficult if the eggs were not seen. The clear ruddy colour is quite distinct from the dull brown pigment of *hufelandi*, but is lost in preserved specimens. The colour, as in *M. coronifer*, etc., is in the fat-cells. Baghghora, 6000 ft., numerous.

M. intermedius Plate (6).—This species I only know with certainty as a Scottish species by the distinctive egg. As to its other structures, I gather from identifications made by Professor Richters that it has claws of the *hufelandi* type, and pharynx of the *echinogenitus* type. No eggs of the species have

been found in India, but an animal having the other structures, viz. claws united halfway and pharynx with three short rods in each row, besides a nut joined to the gullet, and a "comma," was abundant in moss from Baghghora, 6000 ft., and Gokdhara, 3000 ft.

M. echinogenitus Richters (10).—The adult animal and typical eggs occurred in several samples of moss, from Sinihul, 8000 ft., and Baghghora, 6000 ft.

Var. *areolatus* (Murray, Arctic Tard., 13).—Both eggs and adults in three samples of moss from Sinihul, 8000 ft. This form, which I expect to prove of specific value, is distinguished by the areolations, hexagonal or rounded, between the spines of the eggs. The animal, which has frequently been squeezed out of the egg, further differs from the type in that the pharynx always lacks the comma, and the claws are joined for a short distance above the base. Abundant.

Variety of egg.—A large egg of the *echinogenitus* type containing an embryo with the typical pharynx, but having most of the spines forked. Sinihul, 8000 ft.

Variety (fig. 7).—Pharynx and claws of *echinogenitus* type. End of gullet, in pharynx, with unusually wide, divergent flange. Teeth abruptly angled in middle, both portions straight. In the mixed collection; locality unknown.

M. macronyx Duj. (?) (1).—A few examples, Sinihul, 8000 ft., were identified as this species. In view of the discovery that the supposed *macronyx* of Scotland, now called *M. dispar* (5), has spiny eggs, it becomes uncertain to which species the Indian examples should be referred.

M. oberhäuseri Doy (?) (2).—There is no agreement among authors as to this species. The pigment bands, which seem to be generally accepted as the most reliable character, may be absent. No one appears to have found the mulberry-form eggs of Doyère's diagnosis, and connected them with the pigmented animal. Accepting Professor Richters' identification, I find in India several animals having the claws and pharynx as in examples which Richters has kindly sent me from the Taunus. The claws are of the structure usual in the genus *Diphaseon*, and called the *oberhäuseri* type, from this species, and the pharynx has a conspicuous nut joined to the gullet, and two short equal rods, or round nuts, in each row. In moss from Baghghora, 6000 ft., and in the mixed collection; frequent.

M. indicus sp. n., plate XIV. figs. 6a to 6c.

Specific characters.—Very small; claws of *echinogenitus* type V-shaped, one of each pair slightly longer; pharynx nearly round

of *oberhäuseri* type, with a nut joined to the gullet and two larger free nuts in each row; egg smooth, oval, in skin. Skin tubercled, warts in many transverse rows, and many in each row.

Length about 150μ , pharynx 18μ , claws 7μ , fat-cells 6μ , egg 42 by 30μ .

The species resembles *M. tuberculatus* Plate (6), and *M. ornatus* Richters, var. *verrucosus* (?). From *M. tuberculatus* it differs in the type of pharynx (two round nuts instead of three); the warts much smaller and more numerous in each row. The rows are also more numerous. *M. tuberculatus*, if I understand it aright, has four or six large tubercles on each segment, and a similar row on each secondary intermediate segment. *M. indicus* has several rows of tubercles on each segment and intermediate segment.

It is much nearer *M. ornatus* var. *verrucosus*, which has the same type of pharynx, but is distinguished by the larger and regularly arranged tubercles, those of *verrucosus* being of unequal sizes and scattered.

M. suttleri Richters (8).—One example, Singla, 2000 ft. Very small, 150μ long; pharynx with nut fixed to gullet, and three free nuts increasing in size from first to third. This is the same kind of pharynx which I have seen in what I suppose to be *M. tuberculatus*, to which Richters considers this species to be related.

Genus *Diphaseon*.

D. chilense Plate (6).—The only common species of this genus in the Indian moss comes nearest *D. chilense*, though there is some doubt as to the identity. The pharynx is shortly oval, never as broad as long, and it is often as narrow and elongate as in *D. alpinum*. In all the forms there were three very short equal rods, besides a nut and a comma. Sinihul, 8000 ft.

D. sp. (?) A very small form, with very long slender gullet, and shortly oval pharynx, having only two short rods, besides the nut and comma. Being a reduced form, without bearers or teeth, it cannot be named.

Cysts of Diphaseon.—In the one sample from Singla, 2000 ft., there were several cysts of a *Diphaseon* with oblong pharynx, without rods (simplex form), and possessing eyes.

Genus *Milnesium*.

M. tardigradum Doy (?).—Fairly abundant in moss from Darjiling, 6500 ft., and Baghghora, 6000 ft. The shorter claws of these examples had all three points.

LITERATURE.

1. DUJARDIN—Ann. d. Sci. Nat., Paris. 1851.
2. DOYÈRE—Ann. d. Sci. Nat. Paris 1840.
3. EHRENBERG, C. G.—Mikrogeologie, 1854, Atlas, plate 35B.
4. MURRAY, J.—Tardigrada of the Scottish Lochs. Trans. Roy. Soc. Edinburgh, xli. (1905), pp. 677-698.
5. „ Encystment of *Macrobiotus*. Zoologist, Jan., 1907.
6. PLATE, L. H.—Naturgeschichte der Tardigraden. Zool. Jahrb. Morph. Abt. Bd. iii., 1889.
7. RICHTERS, F.—Ber. Senckenbg. Natf. Ges. (1900) p. 40.
8. „ Fauna der Umgebung von Frankfurt-a-M. Ber. Senckenbg. Natf. Ges., 1902
9. „ Verbreitung der Tardigraden. Zool. Anz. Dec., 1904.
10. „ Nordische Tardigraden. Zool. Anz. Dec., 1903.
11. „ Arktische Tardigraden. Fauna Arctica, Bd. iii. (1904) pp. 495-508.
12. SCHULTZE, C.A.S.—*Macrobiotus hufelandi*. Okens Isis (1834) p. 708.
13. MURRAY, J.—Arctic Tardigrada. Trans. Roy. Soc Edinburgh, 1907.